**Who’s Living in Your Lettuce?**

**Key:** Yellow highlight = requiredcomponent

# Subject Area(s) Biology and Data Analysis and Probability

# Associated Unit Microbial life

# Lesson Title Who’s Living in Your Lettuce?

# Header

**Image 1**

**Image file:** \_\_\_?

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 to a blind person; do not repeat caption content.)*

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**Caption:** \_\_\_?

# Grade Level: High School (9-12)

# Time Required: 250 minutes (5 days of 50 minutes each)

# Summary: Students explore the causes, effects, and implications of the E-coli outbreaks in lettuce in the United States. Students will learn effective research practices and how to find credible sources when researching a problem. Then, students will use Engineering practices to come up with a plan targeting one source of contamination in the US lettuce production, and learn how to convey this knowledge to the rest of the scientific community.

# Engineering Connection: Engineers must solve the problems that face society today by applying themselves creatively and scientifically to the issue at hand. Students in this lesson will have to research effectively, analyze the data that’s out there, and creatively develop a plan of action for reducing the incidents of foodborne illness in the world in which they live.

# Engineering Category = 3

# Choose the category that best describes this lesson’s amount/depth of engineering content:

1. Relating science and/or math concept(s) to engineering
2. Engineering analysis or partial design
3. Engineering design process

# Keywords: Lettuce, E-coli, Foodborne Illness, Food, Research, Agriculture, Listeria, romaine, outbreak, contamination.

# Educational Standards (List 2-4)

Source, year, standard number(s)/letter(s), grade band and text (its unique ID# is optional)

[State STEM Standards](https://www.teachengineering.org/standards/browse) (required)

[ITEEA Standards](https://www.teachengineering.org/standards/iteea) (required)

[NGSS Standards](https://www.teachengineering.org/standards/ngss) (strongly recommended)

[CCSS Standards](https://www.teachengineering.org/standards/commoncoremath) (strongly recommended)

ITEEA Standards: (9J): Engineering Design is influenced by personal characteristics, such as creativity, resourcefulness, and the ability to visualize and think abstractly. (9L): The process of engineering design takes into account a number of factors.

Wyoming State STEM Standards: HS-ETS1-1: Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

# Pre-Requisite Knowledge

# Learning Objectives

# After this lesson, students should be able to:

* Identify the source problems of E-coli infection in lettuce.
* Know what E-coli is and where it comes from.
* Develop a plan for reducing the incidents of E-coli in lettuce.
* Support conclusions with well documented research from the scientific community.

# Introduction / Motivation

# Lesson Background & Concepts for Teachers

This lesson is a cross-disciplinary lesson which bridges the gap between Biology classes and Agriculture classes. In Wyoming, where this lesson was written, ranching is hugely important to our economy and lifestyle. The students, especially those connected with ranching families, know the problems with foodborne illnesses in the meat industry. The example used in the lesson is the recent E-coli outbreak in California romaine lettuce. Students living in areas where lettuce farming is close to home will be able to really connect to the importance of reducing the threat of foodborne illnesses. Outbreaks of listeria in cantaloupe could also be focused on. By relating the nature of the microbes which infect these foods to the nature of the animals infected, biology classes can learn more about the Ag industry and Agriculture classes can focus on how biology helps make them better ready for jobs and real world problems.

# Image Insert Image # or Figure # here [use Figure # if referenced in text]

**Figure 1**

**Image file:** \_\_\_?

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 to a blind person; do not repeat caption content.)*

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**Caption:** Figure 1. \_\_\_?

# Vocabulary / Definitions

|  |  |
| --- | --- |
| **Word** | **Definition** |
| E-coli | Escherichia coli: bacteria which usually lives in the intestines of healthy people and animals. Some strains of E-coli produce Shiga Toxin. |
| Shiga Toxin | An extremely potent toxin produced by some strains of E-coli that causes severe symptoms in humans. |
| Primary Source |  |
| Secondary Source |  |
| Tertiary Source |  |
| Foodborne Illness | Illness associated with contamination of food or toxins in food. |
| Strain |  |

# Associated Activities: The main activity during the five days of this lesson is the students’ plan for the reduction of foodborne illnesses. They will be given an overview of the problem at hand; they will be given time to research and put together a written summary of their plan as well as a visual presentation; and they will be given time to present their plan to their peers. The recommended breakdown for each day is summarized in the following chart.

|  |  |
| --- | --- |
| Day One | Lecture: Teacher will go through the power-point provided. (If there has been a more recent food outbreak, you can most certainly focus on that and change the powerpoint to match current events). Slide 2: talk about a recent outbreak, tell what food, where the food came from, what infected the food, and the consequences for people who ate the food. Slide 3: Explain the bacteria responsible for the infection, what it does to people who consume or are exposed to it, and where it is found in nature. Slide 4: Question slide; give the students several open ended questions to think about how the contamination could have gotten into the food. Slide 5: Question slide; give the students some prompting questions about the possibility of reducing these outbreaks. Slide 6: Assignment: introduce the assignment and make groups. Slide 7: Introduce Data Corral and discuss how this website could be useful for researchers, scientists, the FDA and CDC, and lettuce farmers. |
| Day Two | Library Research Day: Coordinate with your Librarian to have a library research day. Ask him or her to give the students insight into where either in books or online they can find the sources they need to support (or develop) their plan. Have the librarian talk about the difference between primary, secondary, and tertiary sources. Today, the students will be in the library the whole time; give the librarian discretion on today’s class period. |
| Day Three | Work Day: Students will be given the whole class period to work on their plans. Try to get laptops available to the students for today’s class so they can look online (as the librarian will have helped them to know how to do) for scholarly articles and information which will support their work. If the students wish to go down to the library, coordinate with the librarian and see if this can be arranged.  Conclusion: About ten minutes before class ends, get the whole group together again to give them options for presentations. Show them how to use prezi or other presentation methods, (video? Visually artistic project?). Have the groups tell you what materials they will need for their project (e.g. science fair board, art supplies, a camera, etc). |
| Day Four | Work Day: Student given whole class period to work on their written report and their presentation. Students will be encouraged to work together on the report, not just have one person write it all. |
| Day Five | Presentation Day: Students will turn in their Post-test (the written version of their plan), and give their presentation as a group. (Again, these presentations can be done as an extracurricular event open to parents, peers, etc.) |

# Lesson Closure: The close of the lesson will be the final presentation. Look for the suggested variation to the lesson as the lesson extension activity.

# Assessment

**Pre-Lesson Assessment**

*Descriptive Title:* Pair and Share about Foodborne Illnesses: Have the students talk to their neighbor and discuss the answers to the following questions: 1. What is a foodborne illness and what causes it? 2. What do you think could be done to reduce foodborne illnesses?

**Post-Introduction Assessment**

*Descriptive Title:* \_\_\_?

**Lesson Summary Assessment**

*Descriptive Title:* Foodborne Illness Reduction Plan: Students will complete two summative assignments, a written plan, and an oral and visual presentation. The instructions and criteria are included in the student worksheet.

**Homework**

*Descriptive Title:* \_\_\_?

# Lesson Extension Activities

# Classes are encouraged to coordinate an extracurricular event at which the students can present their plans in front of an audience. Making a big deal out of it by inviting their parents, friends, peers, and other faculty and staff of your school will give the students some experience as members of a scientific community. Consider providing snacks and let the students write discussion questions for the audience.

# Additional Multimedia Support

# References

Dewey, C. (2018, 04, 30). Why E. coli keeps getting into our lettuce. *The Washington Post.* Retrieved from https://www.washingtonpost.com/news/wonk/wp/2018/04/26/why-e-coli-keeps-getting-into-our-lettuce/?noredirect=on&utm\_term=.2df1832ae000

# Attachments

**Other**

**Redirect URL**

# Contributors: Nycole Marsh, Gemma Szott

**Supporting Program: University of Wyoming teacher education program**

# Acknowledgements

**Classroom Testing Information: Not tested in any classrooms yet.**